A LONGITUDINAL INVESTIGATION OF THE COMMUNICATIVE INTERACTION BETWEEN MOTHERS AND DEAF CHILDREN

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Research has shown that mothers of hearing-impaired children use a more controlling style of interaction than mothers of normal children. The present study was designed to study the relationship between maternal control and the communicative competence of preschool-aged children with severe and profound hearing losses, as well as the relationship between communication mode and maternal control. The sample consisted of pairs of children and their mothers, one member of each pair using auditory/oral (A/O) and the other using total communication (TC). The pairs were roughly matched for age, communicative competence, and intelligence. The findings indicated that both A/O and TC mothers were highly controlling [i.e. tended to dominate the interaction (i.e. took considerably more turns than the children) and were highly directive (rather than responsive) in style]. A/O and TC mothers did not differ from each other in level of conrol. TC children, however, were more directive than A/O children, meaning that control was shared to a greater extent in TC mother-child pairs. Within both groups, mothers decreased their level of control as their children's level of communicative competence increased. This is similar to what occurs with hearing children, and indicates that the degree of control shown by mothers of hearing-impaired children is partly a response to their children's lesser language capabilities. There was some evidence, however, that higher rates of control were associated with slower growth in communicative competence. These findings, along with others related to the communicative style of the mothers, have implications for the development of a training program to facilitate communication between mothers and their hearing impaired children.

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Research has shown that mothers of language-delayed children use a more controlling style of interaction than mothers of normal children. The early literature took a "strong" view of the relationship between mother's input and children's development, arguing for the presence of a causal connection (e.g., Cross, 1984). Language practitioners used the profile of the normal child's mother as a model for intervention, training parents to be less controlling (e.g., McDonald & Horstmeier, 1978; Manolson, 1983).

Several more recent studies have argued for a "weak" interpretation of the relationship, i.e. that mothers' control is a response to their children's lower level of development rather than its cause (e.g., Tannock, 1985; Light et al., 1985). Some research suggests that mothers of language delayed children are less responsive to changes in their children's level of functioning, and continue to be highly controlling even when it is no longer appropriate (see Cross, 1984).

The few studies of hearing impaired children raise similar problems of interpretation. Schlesinger & Meadow (1972) found that mothers of deaf children were more controlling and intrusive than mothers of hearing children. Greenberg (1980) further found that mothers' control varied with the children's communicative competence. Meadow et al (1981) showed that it was the auditory/oral pairs, in contrast to those using total communication, that had low levels of language ability and correspondingly higher levels of control. Nienhuys, Cross, and Horsborough (1984) found no differences in the incidence of various sentence types between mothers of hearing-impaired and normal children matched for language level. These studies support the "weak" view of the relationship between maternal input and development.

A longitudinal study by White and White (1984) failed to find a relationship between maternal control at 24 months of age and children's rate of language development over the ensuing 1 1/2 to 4 1/2 years. They did, however, find a relationship between children's social adjustment and the extent to which maternal control "matched" the children's language level. That is, well adjusted children had mothers who adjusted their level of control as the child's language level increased. Greenberg & Marvin (1979) found that deaf children showed more immature attachment behavior and less independence than hearing children at similar language levels, further supporting the notion that mothers may continue patterns which are no longer appropriate.

Studies of mother-child interaction have typically defined "control" as the use of behavioral imperatives. Some studies (e.g., Tannock, 1985) have defined control more broadly to include questions as well as behavioral commands. Studies of teacher-child interaction have been concerned with the relative degree of control exerted by different question types, differentiating questions that test students' knowledge from those that solicit new information. These studies have also been concerned with the imbalance between teachers and children in the

number of utterances (e.g., Amidon & Grammatteo, 1967; Mischler, 1975.

The present study was a longitudinal investigation of the relationships among communication mode, language level, degree and type of maternal control, rate of language development, and social development, testing the following hypotheses:

1. Maternal control will be negatively associated with children's communication ability.
2. When communication ability is controlled, maternal control will be unrelated to mode of communication.
3. Maternal control will decrease over time.
4. Maternal control will be negatively associated with the increase in children's communicative competence over time.
5. Maternal control will be negatively associated with the increase in children's social development over time.

Method

Sample

The sample consisted of pairs of preschool children with severe and profound hearing losses, one member of each pair using auditory/oral (A/O) and the other using total communication (TC). The pairs were roughly matched for intelligence, age, and ability to communicate with their mother. The sample was drawn from a larger investigation of the development of preschool deaf children (Musselman, Lindsay, & Wilson, 1988). The parent study utilized a large, representative sample of 153 hearing impaired children. Data were collected in three rounds: once when the children were 3, 4, or 5 years of age and twice again in the subsequent three or four years. The present study utilized data collected during the first and final rounds. The sample for the present study consisted of all possible matches from the larger sample that met the matching criterion.

Differences between the groups and over time were analyzed using one and two-way analyses of variance with mode as a fixed factor and time, where relevant, as a with-in subjects factor. Table 1 presents the average scores on each criterion for the A/O and TC groups in each round, and indicates the levels of significance associated with each factor as well as the interaction term.

1. Age. Children were three, four, or five years of age in the first round, and five, six, or seven years of age in the final round. Children were matched as closely as possible on age. In the first round, the A/O group averaged 4-5 and the TC group averaged 4-6 years. In the final round, the A/O group averaged 6-11 years, and the TC group 6-10 years. These differences were not significant. Absolute differences between the members of a pair ranged from 0 to 7 months in the first and 0 to 8 months in the final round.

2. Intelligence. Children were administered the performance section of the WISC-R intelligence test in the final round. The parent sample was divided at the mean into high and low scorers, and the sample pairs drawn from the same IQ category. Analysis of variance showed that the two groups did

not differ significantly. A pair-by-pair analysis showed that A/O children had the higher absolute score in 8 pairs, TC children in 7 pairs, with no difference in 2 pairs.

3. Expressive and Receptive Mother-Child Communication. Mothers and children completed a series of communication tasks, which yielded an expressive and a receptive score for each child. In the expressive test, the mother requested the child to name a set of items. A child's expressive score was the number of labels that were recognizeable and semantically correct. The receptive task consisted of a series of referential communication tasks, ranging in complexity from individual words to phrases to brief stories presented by the mother. Children demonstrated comprehension by object or picture selection. A child's receptive score was the number of items correctly comprehended. Mothers and children were free to use whatever mode or modes of communication they chose.

The sample from the parent study had been divided at the mean into high and low scorers, and each pair in the present sample was drawn from the same group. Analysis of variance of the expressive score showed no significant difference between the two groups, but a significant increase over time. Pair-by-pair comparisons of the first round scores showed that A/O children had the higher score in 8 pairs, TC children in 10 pairs, with no difference in 2 pairs. In the final round, A/O children had the higher score in 5 pairs, TC children in 3 pairs, with no difference in 9 pairs. Analysis of the receptive score also found no difference by mode, but a significant increase over time. In the first round, A/O children scored higher in 9 pairs, and TC children scored higher in 7 pairs, with no difference in 1 pair. In the final round, A/O and TC children each scored higher in 7 pairs, with no difference in 3 pairs.

Sentence Comprehension

The Language Assessment Battery (LAB) was administered in order to provide a measure of the children's linguistic competence independent of their mother's competence. The LAB test had been developed by the authors to assess deaf children's comprehension of English syntactic structure (Reich, Keeton & Linsday, 1981). This study used the score from a modified version of the screening test which had been adapted for preschool-aged children. The screening test consists of 41 sentences arranged in developmental order. Each sentence is presented in the mode of communication used at school (i.e., speech alone or simultaneous method), and the child demonstrates comprehension by manipulating the figures and objects in a doll's house. A child's score is the number of sentences correctly enacted.

Analysis of variance showed a marginally significant difference in favor of the TC group. In the first round, TC children scored higher in 7 pairs, A/O children in 3 pairs, with no difference in 1 pair, and 6 pairs in which both children scored 0. In the final round, TC children scored higher in 12 pairs and A/O children in 5 pairs.

Social Development

Social development was assessed with a measure devised for use in the parent study. This measure, which was based on work by Alpern and Boll (1976) and by Gessell (1949) assesses self help skills, social relations, and social comprehension independent of language ability. Analysis of variance showed no significant differences between the two groups in the present study, with both groups increasing significantly over time.

Representativeness of the Sample

Comparisons revealed that A/O children had significantly more hearing than the TC children, an average of 97 db (ANSI, 1960) compared to 107 db. (see Table 1). The A/O children scored higher in 14 of the 17 pairs. A/O children also scored higher on measures of spoken langupage. For example, A/O children produced an average of 40 intelligible words in a spontaneous sample of connected speech, while TC children averaged only 5.3 words ($F(1,30) = 6.08$, $p = .020$). In only one pair did the TC child score higher.

These two groups were also compared with children in the parent study who had similar educational histories, but for whom no matches were available. There was a nonsignificant tendency for the A/O sample group to have less hearing, lower IQ, and to score lower on some language measures than the remainder of the A/O children in the parent sample. The sample TC group, on the other hand, tended to have more hearing, higher intelligence, and to score higher on some langauge meaures. Several of these differences were marginally significant.

These differences reflect the fact that, within Ontario, children tended to be first placed in A/O programs and later changed to TC programs if their progress in spoken language was unsatisfactory. Consequently, children placed in and remaining in A/O programs had more hearing and better spoken language than TC children. Children in TC programs, however, had similar scores to A/O children on receptive language and mother-child communication (Musselman, Wilson & Linsday, in preparation). In order to obtain groups which were matched on mother-child communication, it was necessary to select pairs which differed widely in degree of hearing loss and spoken language. Therefore results of the study cannot be used to assess the overall outcomes of A/O and TC programs. However, given the broad sampling base, results concerning the characteristics of mother-child interaction can be generalized with a high degree of confidence.

Procedure

Mothers and children were videotaped in a free play session with a doll's house and appropriate toys. Mothers were instructed to play with their child as they would at home, using whatever mode or modes of communication they normally used.

Coding

A coding system was devised which reflects the degree and nature of maternal control. The system identifies and codes all communicative acts (CAs), including speech, signs, and gestures,

whether manual, facial, or postural. The coding system consists of a set of mutually exclusive and exhaustive categories (see Table 2). The coding system makes a basic distinction between communicative acts which attempt to control subsequent interaction and those which do not. The first control category is corrects, in which the speaker expresses displeasure with either previous behaviors or CAs of the listener. Other control categories require a specific response from the listener, and are distinguished by the type of response required: behaviour, language (i.e., prompt), or test information. Sometimes it was possible to identify a child's CA as attempting to exert some type of control, although, due to incompleteness or unintelligibility, it was not possible to specify the type of demand. In this case, an undifferentiated requires category was used.

Non-controlling CA's include requests for permission, requests for clarification, real questions, statements, expansions, and conversational devices. CAs which represented the speaker playing the role of one of the doll figures were coded as a pretend. Pretend CAs which were directed at the partner were double-coded to represent their communicative function.

CAs which could be assigned to a functional category but were partially unintelligible were double-coded as such. CAs which could not be assigned to a functional category were coded as incomplete, not visible, or totally unintelligible.

In addition to the frequency of specific categories, two indices of maternal control were computed. Maternal dominance is the percentage of all CAs in an interaction emitted by the mother. Maternal directiveness is the percentage of all maternal CAs that are controlling.

A reliability study was conducted using a second research officer. A subsample of roughly 60 CA's was selected from the middle of 20 interactions. The reliability for identifying and sequencing CAs was 92% for mothers and 88% for children. The reliability for assignment of CAs to communicative functions was 90% for mothers and 92% for children.

All coding was done by a single research officer who has deaf parents, extensive experience with deaf children using a variety of communciation modes, and who is a certified sign language interpreter.

Data Analysis

Differences between groups and over time were analyzed using two-way analyses of variance with mode as a fixed effect and time as a repeated measure. Simple correlations were used to investigate the relationships between child characteristics (age, hearing loss, intelligence, communicative competence, social development) and mothers' input. Regression analyses were used determine the relationships between maternal input and children's growth in communicative competence and social development. Factor analyses and regression analyses were used to explore the relationships among communicative functions and the effect of

related functions on development.

Results

Intelligibility

Very few CAs were coded as not visible (a total of 3 for mothers in the first round and 2 in the final round; a total of 8 for children in the first round and 9 in the final round). Less than 1% of mothers CAs were totally or partially unintelligible (see Table 3). These figures did not vary significantly by mode or by time. Additionally, 1 - 2% of mothers' CAs were too incomplete to be coded. The incidence of incomplete CAs increased significantly over time, with no difference between modes.

The children, however, produced large numbers of CAs that were totally or partially unintelligible, with significant differences by mode and by time. In the first round, 16.4% of the CAs of AO children were completely unintelligible compared to 8.0% of the CAs of TC children, a pattern appearing in 14 pairs. In the final round these figures had decreased to 8.0% and 2.2%, respectively; A/O children had the higher absolute number of unintelligible utterances in 12 pairs. A/O children also exceeded TC children in the percentage of utterances that were partially unintelligible. The small number of incomplete CAs did not vary significantly by mode or by time.

Maternal Dominance

Sessions in the first round ranged from 3.3 minutes to 12.1 in length, with a mean of 8.8 minutes (sd = 2.64). A/O pairs averaged 8.6 minutes of interaction and TC pairs averaged 9.0 minutes (see Table 3). Sessions in the final round ranged from 5.4 to 13.3 minutes, with a mean of 10.1 (sd = 1.75) in both groups. Analysis of variance showed no significant differences associated with mode, but a significant increase over time ($F(1,32) = 7.38$, $p = .011$).

Although A/O and TC pairs did not differ by mode in the length of the interaction, there was a difference in the number of mothers' CAs and, consequently, in the mothers' CA rate per minute. There was also a significant overall decrease in the CA rate over time. In the first round, A/O mothers averaged 13.1 CAs during the interaction and TC mothers 9.7 CAs, a pattern repeated in 12 pairs. In the final round, A/O mothers averaged 10.4 CAs, and TC mothers averaged 7.1 CAs, a difference which also appeared in 12 pairs.

The children's rate differed marginally by mode, but not by time. A/O children averaged 6.2 CAs per minute in the first round, while TC children averaged 5.5; their respective average rates in the final round were 6.8 and 4.6 CAs per minute, a difference which was replicated in 12 pairs. However, when completely unintelligible utterances were eliminated and communication rate recalculated using only those utterances that were codeable (i.e., partially or totally intelligible), the communication rate of the two groups no longer differed.

As is evident from the above, mothers dominated the conversational space. In the first round, A/O mothers accounted

for 67% of all CAs occurring during the interaction, and TC mothers for 64%, a difference which was not significant. These figures decreased significantly over time to 59% and 61%, respectively, a decrease which was evident in 24 of the 34 mother-child dyads. Similar percentages result from an analysis of codeable CAs.

Mothers' Communicative Functions

For each subject, the percentage of CAs falling into each of the function categories was determined at each point in time, and the data analyzed using analyses of variance. Similar analyses were performed on the overall percentage of directive and nondirective CAs. Table 4 presents the mean percentage on each of these measures for A/O and TC mothers in each round, and indicates the level of significance for the main effects of mode and time, as well as the interaction term.

The data show that the directive categories accounted for 33% of all CAs in the first round and 28% in the final round. Behavioral requests accounted for the bulk of directive CAs: 8-27% of all CAs across groups and time. Test questions accounted for approximately 5%, while requests for language and corrections never exceeded 4%. Statements comprised the largest category of nondirective CAs statements, accounting for approximately one-third of all CAs. Conversational devices accounted for approximately 20%. Real questions accounted for 6 - 17%, and expansions for 5 - 8%. The remaining categories were relatively infrequent.

These data show little change over time. There was a nonsignificant tendency for directiveness to decrease over time (p = .108). This trend reflects a significant decrease in the use of behavioral requests (a change which was evident in 27 dyads), and a significant increase in the use of real questions (a change evident in 27 dyads).

There was only one significant difference between mode groups: TC mothers used more requests for clarification than A/O mothers. This was less evident in the first round, where TC mothers scored higher in only 7 pairs, with 5 pairs showing an advantage to A/O mothers and 5 showing no difference. In the final round, TC mothers scored higher in 10 pairs, and A/O mothers scored higher in 4 pairs, with no difference in 3 pairs.

Children's Communicative Functions

Table 5 presents the data on children's communicative functions. The directive categories had relatively low frequencies of occurrance, together never exceeding more than 17% of all CAs. There was a marginally significant decrease in directiveness over time. This reflects a marginally significant decrease in the incidence of behavior requests, a change evidence in 21 of the 34 dyads. There was a marginally significant increase in the incidence of real questions, a change which was evident in 18 dyads. The incidence of statements increased significantly from approximately 40% to over 50%, an increase which was evident in 26 dyads. There was a significant increase in expansions, an increase evident in 23 dyads. The incidence of

conversational devices decreased significantly, although the decrease was evident in only 17 of the 34 dyads.

There were several significant effects associated with mode. TC children had a marginally higher incidence of directive CAs, a difference which was evident in 12 pairs in the first and 11 pairs in the final round. TC children used more ambiguous requests, a difference which was apparent in roughly half of the pairs in each round. TC children also made marginally fewer requests for clarification. Due to the limited incidence of clarification requests in the first round, this difference was not evident in the pair-by-pair comparison, but was evident in 11 pairs in the final round.

Determinants of Maternal Input

Simple correlations were computed in order to determine characteristics of the children which were associated with maternal input. These are summarized for the first round in Table 6 and for the final round in Table 7.

In both rounds, maternal dominance was negatively related to age and to each of the communication measures as well as the social development measure, indicating that maternal dominance decreased as age and developmental level increased. Mothers' directiveness was not related to any of the developmental measures in the first round, but was negatively related to sentence comprehension and social development in the final round. Scattered negative relationships exist between each of the four directive categories, and age and development.

Among the nondirective categories, use of real questions, expansions, and conversational devices show positive relationships to the developmental measures in both rounds. Use of pretend statements was positively related to all developmental measures in the first round. Requests for clarification were related to the developmental measures in the final, but not the first round.

Two nondirective categories -- requests for permission and statements -- unexpectedly show negative relationships to development in both rounds. Pretend statements were negatively related to development in the final round.

A number of maternal input measures were related to hearing loss. In both rounds, maternal directiveness increased with increasing hearing loss, as did the incidence of several directive categories. In the first round, the use of real questions was negatively related to hearing loss. These relationships do not reflect communicative competence, since hearing loss was not significantly related to any of the developmental measures.1

There were several relationships between maternal input and intelligence. In the final round, use of corrections was negatively related to intelligence, while use of statements was positively related. The remaining relationships between input and intelligence were in a direction opposite to that expected. Maternal dominance increased with increasing IQ, while use of conversational devices in the first round and expansions in the

final round increased.

Effects of Maternal Input on Development

The effects of maternal input on children's rate of development was investigated using regression analysis. The score on each developmental measure in the final round served as the dependent variable in a separate equation. A forced entry model was used to enter the following independent variables in the order specified: age, the relevant developmental score in the first round, a measure of maternal input. Analyses were conducted on each dependent variable using the indices of maternal dominance and directiveness, as well as the incidence of each functional category.

Separate analyses were also conducted on the residual scores from each developmental measure. Using equations derived from an analysis of the parent sample, residuals were calculated to adjust for the effects of age, hearing loss, and IQ, variables which were related to development in the larger sample. These scores estimate the extent to which children deviated from the level of development that is be predicted by their background characteristics. Analysis of these scores provides the most rigorous test of the effects of maternal input.

The analysis of maternal dominance is summarized in Table 8. Analyses of the raw scores show that dominance had a significant negative effect on the expressive communication score, indicating that a high rate of maternal dominance was associated with slower growth in expressive communication skills over the time between rounds. Maternal dominance was not associated with change in any of the other communication scores, but was positively associated with growth in social development. This finding is spurious and reflects the existence of a significant negative relationship between dominance and social development in the first round (see Table 6) together with a smaller, marginally significant association in the final round. The first round score, therefore, acts as a suppressor variable on the final round score. No significant relationships were found between dominance and any of the residual scores. The analyses of maternal directiveness, which are also summarized in Table 8, reveal no significant relationships to either the raw or residual developmental scores.

Table 9 summarizes the analysis of the relationships between the functional categories and the raw developmental scores, and Table 10 summarizes the analysis of the residual scores. Analysis of the raw scores reveals a marginally significant association between maternal expansions and growth in receptive communication. Analysis of the residual scores reveals several marginally significant negative relationships: between the incidence of requests for action and growth in receptive communication, between statements and sentence comprehension, and between pretends and expressive communication. The use of statements was also associated with a marginally significant positive relationship to receptive communication. This relationship, however, is spurious due to the action of the first

round receptive communication score as a suppressor variable.

Several significant relationships were obtained between communicative function and social development. Use of corrections had a significant negative relationship to the raw social development score and a marginally significant negative relationship to the residual score. Requests for permission had a significant negative relationship to the raw score.

Factor Analysis of Mothers' Communicative Functions

The relationships among communicative functions were explored using factor analysis. A principal components analysis with varimax rotation was conducted on the first and final round data. As a satisfactory solution was only achieved in the first round, the following observations are suggestive, rather than definitive.

In the first round, four factors emerged (see Table 11). Using a criterion of .40 or higher, the first factor was found to load with real questions, expansions, and test questions. This factor might be considered to tap communicative interaction, since all three functions involve a high degree of linguistic contingency. The second factor consists of requests for language, clarification requests (which has a negative loading), and statements. Factor 2 might be considered a didactic factor. The third factor consists of pretends and requests for action, categories which directly involve manipulative play. The fourth factor consists of corrections and conversational devices, the latter of which also loads on the first factor. Taken in conjunction with our impressions of the first round tapes, we would consider this factor to indicate pseudo-interaction, since neither of these categories substantively advances the interaction. Thus the factor structure suggests that there are three modes of interaction and a style of empty interaction occurring at this age period, the three modes of interaction being communicative, didactic, and play.

Determinants and Effects of Maternal Factors

Table 12 presents the simple correlations between the four factors from the first round data and children's characteristics and developmental scores. The communicative interaction factor was positively related to age, negatively related to hearing loss, and positively to each of the communication and social development measures. The didactic factor was negatively related to age and negatively related to each of the communication measures. Manipulative play was positively related to the expressive and receptive communication score, and "pseudo-interaction" was positively related to hearing loss and intelligence.

The effect of each factor on each developmental measure was investigated using a regression analysis of age, the first round score, and the factor scores on the final round score. Since the factors are independent, all four were entered into the same equation. Analysis of the raw scores found a negative association between play (factor 3) and growth in expressive vocabulary (partial $r = -.39$, $t = -2.63$, $p = .02$), and a positive

association between communicative interaction (factor 1) and growth in social development (partial r = .41, t = 2.49, p = .02). Analysis of the residual scores found no effects associated with any factor.

Discussion

Information Exchange

Many of the children's CAs were totally or partially unintelligible, 10 - 30%. This is higher than the figure of 3% reported by Day (1986). However it appears that the latter study only included manual gestures, while the present study also included facial and postural gestures. Thus, when all communicative attempts are considered, it becomes apparent that much of the communication between deaf children and their mothers is unsuccessful.

Both mothers and children also used a large number of conversational devices, roughly 20%. This is similar to the figure of 18% obtained by Day. While some conversational devices, such as calls for attention and positive feedback, are important to the maintenance and regulation of the conversation, the high incidence of CAs which are nonsubstantive appears problematic.

These data on the incidence of unintelligible and nonsubstantive CAs, together with the qualitative impressions created by the tapes, suggests that communication between mothers and their hearing-impaired children is labored. Much of the communication jthat does occur can be further characterized as "empty," that is, having the form of interaction, but lacking meaningful content.

Level of Control

Maternal Dominance. Considering only CAs that were partially or completely intelligible, children were found to emit an average of 5.0 CAs per minute in the first round. It is possible to calculate communication rates from the data presented by Meadows and her colleagues who studied children of the same age as those in the first round of the present study. Their study, which excluded unintelligible utterances, obtained a similar rate of 5.3 CAs per mintue. These researchers obtained considerably higher communication rates for hearing children, 10.5 CAs. Thus hearing impairment appears to be associated with lower communication rates for children. Mothers, therefore, dominate the conversational space, accounting for roughly two-thirds of all CAs (65% in the present study and 71% in the Meadows' study).

Maternal Directiveness. Thirty-three percent (33%) of mothers' CAs in the first round were directive. The directive category with the highest incidence of occurrance was behavioral requests. In the present study, roughly 20% of mothers' CAs were behavioral requests, compared to 14% in Meadows' study. Thus mothers in the present study appeared to be even more controlling than previously found. This may reflect the fact that the Meadows study used samples of convenience; the oral children in that study had been recommended by their school directors, and

the TC children were all selected from one school. The present study, however, used a more broadly representative sample.

Hypothesis 1

Hypothesis 1 proposes that maternal control is related to children's communicative competence. This hypothesis is supported by the presence in both rounds of significant negative relationships between maternal dominance and communicative competence, and the scattered negative relationships between the directiveness index as well as the incidence of specific directive functions (correction, requests for action, requests for language, test questions) and communication competence.

Maternal control, however, was also related to characteristics of the child other than communicative competence. A number of significant relationship were noted between maternal input and children's social development. Maternal input was also related to age and hearing loss. While age was related to the communication measures and thus reflects developmental level, hearing loss was not. Hearing loss, however, was related to measures of spoken language. It might be supposed that the relationships between directiveness and hearing loss would disappear if spoken language ability were taken into account. This hypothesis was testing using a regression analysis of the number of intelligible words as well as hearing loss on each of the relevant directive categories. This resulted in the elimination of the significant relationship between hearing loss and the incidence of real questions, but significant relationships remained between hearing loss and requests for action, requests for language, and corrections.

Mothers' input was also related to IQ, although some of the relationships were not in the expected direction. These findings indicate that maternal input is not simply a response to the communicative competence of the child. The child's social development is also a factor, as are characteristics of the child other than developmental level.

Hypothesis 2

Hypothesis 2 predicts that, when children are matched for communicative competence, A/O and TC mothers will not differ in the level of control. Consistent with the hypothesis, few differences were observed between groups.

Maternal Dominance. The A/O and TC groups did not differ in the length of the interaction. A/O mothers, however, were found to have significantly higher communication rates than TC mothers. This finding, which is consistent with Meadows *et al* (1981) and with Greenberg (1980), is attributed by Greenberg to the A/O mothers' greater use of self-repititions. It is reasonable to suppose that this derives from the lesser intelligibility of the A/O children. The communication rates of A/O and TC mothers were thus compared using analyses of variance with children's unintelligibility rates included as a covariate. In the first round, the rates of A/O mothers were still significantly higher than those of TC mothers ($F(1,31) = 5.23$, $p = .029$), although differences in the final round were no longer

significant.

A/O children in the present study also had a higher communication rate than TC children. This difference again disappeared when unintelligible utterances were eliminated. It thus appears that, due to problems of unintelligibility, both partners in an A/O dyad must produce more communicative attempts in order to match the communication rate achieved in TC dyads.

Maternal Directiveness. A/O and TC mothers did not differ in overall levels of directiveness, nor in the incidence of most functional categories. TC children, however, were marginally more directive than A/O children, and produced significantly more ambiguous requests. Therefore, although the two groups of mothers did not differ significantly, control was more evenly shared in the TC dyads.

TC mothers also used more requests for clarification. Given that A/O children were significantly less intelligible than TC children, this difference likely reflects greater confidence on the part of TC mothers that clarification is possible. TC children, however, had a marginally lower incidence of clarification requests than A/O children.

Hypothesis 3

Hypothesis 3 proposes that mothers will decrease in control over time. This is supported by the significant decrease in mothers' communication rate between rounds. A decrease was also observed in maternal directiveness, but it was not significant. There was, however, a significant decrease in the incidence of requests for action, and an increase in real questions. Thus the hypothesis receives partial support.

However these changes appear minimal and less than those which have been documented for hearing children. Nienhuys, for example, found that imperatives comprised 15% of maternal CAs to one-year-old hearing children, decreasing substantially to 9% to two-year-olds. The decrease among mothers in the present study was considerably less over an interval of 3 to 4 years.

It is interesting in this regard to compare the levels of maternal directiveness of children scoring high and low in communicative competence. Children were divided into high and low scorers on the basis of their receptive communication score in the first round. Mothers of low scorers averaged .35 directive CAs, and mothers of high scores averaged .32. In the final round, the respective figures were .35 and .22. This represents a significant main effect for group ($F(1,32) = 4.90$, $p = .034$) and a marginally significant group x time interaction ($F(1,32) = 3.07$, $p = .090$). It is interesting that the two groups of mothers were similar in the first round and different in the final round. It may be that a threshold effect is operating, with mothers of hearing-impaired children continuing te be highly directive until the children achieve some minimal level of competence.

Hypothesis 4

Hypothesis 4 proposes that maternal control is negatively related to the increase in children's communicative competence

over time. This hypothesis was confirmed for maternal dominance, which showed a negative association with the increase in the expressive score. There were no associations between overall directiveness and growth. However several meaningful associations were noted between the incidence of specific functional categories and development, although all were only marginally significant. A negative association was observed between requests for action -- a directive category -- and growth in the raw receptive communication score. There was also a significant negative association between the play factor and growth in expressive vocabulary, a factor which primarily reflects the incidence of requests for action.

A positive association was obtained between expansions -- a nondirective category -- and the residual receptive score. However, another nondirective category -- statements -- was negatively associated with growth in the residual sentence comprehension score.

Hypothesis 5

Hypothesis 5 proposes that maternal control will be negatively associated with growth in social development. This hypothesis receives some support from the negative relationships observed between use of corections and growth in social development, as well as the positive relationship between growth in social development and the communication factor.

General Conclusions

Overall these results provide little support for a general construct of maternal control. Maternal dominance showed the expected pattern of relationships with the dependent variables as well as the expected changes over time, while the overall directiveness index did not. Several of the relationships between communicative functions (requests for permission, statements) and development were in a direction opposite to what was expected. Furthermore, factor analysis of the functional categories produced a solution in only the first round, a solution which involved unexpected associations of "directive" and "nondirective" categories. This is consistent with the fact that differences were observed between rounds in the pattern of relationships between maternal input and characteristics of the children, suggesting that mothers were responding to different characteristics of the children at the two points in time.

This fact confounds testing of the motherese hypothesis. The existence of several unexpected relationships and the action of suppressor variables make interpretation of the results difficult. Nevertheless the data provide some support for this hypothesis. Some indices of maternal control were associated with children's communicative competence and were shown to affect development over time. The use of requests for action was shown to be negatively related to development, while expansions were positively related. These findings are consistent with those from studies of hearing children (e.g. Newport, Gleitman & Gleitman, 1977; Gleitman, Newport & Gleitman, 1984). This is the first study that has obtained direct evidence that similar

factors affect the development of hearing-impaired children.

The only other longitudinal study of deaf children (White & White, 1984) failed to find an association between maternal input and language development. The discrepancy may arise from differences in the measures used or differences in the sample. White and White, however, did find that maternal input affected social development, a finding which was replicated by the present study. In fact the effects of input on social development were larger and more consistent with expectations than those associated with communicative competence. Gleitman, Newport and Gleitman (1984) argue that only closed-class items (i.e. functors) are sensitive to maternal input. The measures used in the present study, however, primarily reflect open-class features. It is possible that maternal input to deaf children has more widespread effects since the input these children receive is limited. The present study also investigated development over a considerably longer period of time than the studies discussed by those researchers.

Nevertheless, the lack of clear effects and the overall pattern of findings suggest that it is necessary to consider the content of interactive episodes in more detail. Kenworothy (1987) proposes that it is the contingency of the mother's utterances that affects growth in communicative competence. What may be important is not the mother's degree of directiveness, but her use of both directive and nondirective communicative acts in developing a cohesive and coherent exchange.

A specific aspect of cohesion is the appropriate use of repair strategies. The high incidence of unintelligible utterances among deaf children provides a multitude of spontaneous opportunities for mothers to embed language instruction within a meaningful repair sequence. Within the present study, however, mothers made little use of clarification requests. Kenworothy also found that mothers did not query unintelligible utterances, but tended to respond by changing the topic. It is our impression that the high incidence of behavior requests and conversational devices, together with the low incidence of clarification requets, represents a strategy for avoiding conversation with the deaf child and its attendent problems of intelligibility.

The findings support the notion that differences observed in previous studies between A/O and TC dyads primarily reflect group differences in communicative competence. In the present study, where children were matched for communicative ability, few differences were observed. However communication in A/O dyads was more labored, and the interaction within TC dyads was more balanced, with mothers and children sharing control to a greater degree.

Nevertheless, the overall impression in both groups was of severely impaired communication. Interaction was characterized by high rates of unintelligible utterances and empty exchanges. Maternal directiveness was related, not only to the children's communicative competence, but to their degree of hearing loss.

Changes observed in maternal input over time did not appear commensurate with the children's development. In was particularly interesting to observe that mothers of children who had relatively high levels of communicative competence in the first round were as directive as mothers of children scoring low. Mothers of the high-scoring children, however, became less directive over time, while mothers of the low-scorers did not. Response to growth, therefore, appeared to be delayed and supports the notion that mothers of deaf children are less flexible in adjusting to changes in the child. While mothers decreased the extent to which they dominated the conversational space, they did not fine-tune their input to the child's changing abilities. Nienhuys, Cross, and Horsborough (1984) also noted little difference between mothers of two-year-old and five-year-old deaf children on some indices of maternal input. The overall pattern is consistent with their suggestion that maternal input is controlled more by mothers' beliefs about their deaf children than by the children's communicative competence. In addition, we propose two additional mechanisms, which vary by communication mode.

One factor is family participation in programs which train parents as language mediators. Cole & Mischook (1985) found that preschool programs primarily emphasize direct instruction, and our experience indicates that this is also true of parent training programs. Fifteen of the 17 A/O mothers had participated in such programs in their child's early years. This was only true for 9 of the 17 TC dyads. Such instruction may impose highly controlling styles of interaction, resulting in decreased responsiveness to changes in the child's abilities.

Problems of interaction in the TC dyads were further compounded by the mothers' lack of sign language fluency (cf. Bornstein, 1980). Mothers' signed utterances were slow and halting, with an absence of natural rhythmn and stress. Mothers also did not generally provide a visual analog to the intonational changes in their speech which help to differentiate among questions, commands, and statements. Thus children often failed to correctly interpret the pragmatic force of their mother's utterances. Similarly, TC children failed to learn these strategies themselves, evidencing a high level of ambiguous requests in their own communications. Thus interaction in these dyads appeared to remain at an immature level because of specific problems related to sign language fluency.

Future research in this area needs to consider the impact of parent training and sign language fluency in more detail. Schlesinger (1985) argues that extensive use of control strategies is common among a variety of groups which can be characterized as powerless. In the case of hearing-impaired children, the mother is powerless to elicit age-appropriate communicative behaviors from her child, and powerless to obtain smooth, satisfying interaction. Educational programs need to be developed which first empower the mother as a communicator, and only subsequently as a language trainer. Research is needed to

determine the extent to which such parent training programs are effective in changing parental input and the effects of such changes on children's growth.

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Footnotes

1 The usual relationships between hearing loss and language development are obscured for these measures by the matching procedure used to select the sample and by the testing of children in their preferred mode of communication.

Table 1

Summary of Analyses of Variance on

Characteristics of A/O and TC Groups

	Group Means				p Value		
	First Round		Final Round				
Measure	A/O	TC	A/O	TC	Mode	Time	MxT
Background Characteristics							
HTL	97	107	na	na	*	na	na
Age	4-5	4-6	6-11	6-10	-	-	na
IQ	na	na	110	109	-	na	na
Communicative Competence							
Mother-Child Communication							
- Expressive	9.6	10.1	22.3	22.4	-	***	-
- Receptive	17.6	18.0	36.2	37.5	-	***	-
Sentence Comprehen	2.7	5.6	15.4	20.5	+	***	-
Social Development	80.8	84.4	110.3	113.6	-	***	-

+ $p < .10$; ** $p < .05$; ** $p < .01$; *** $p < .001$.

Note: HTL is the hearing threshold level, measured as the average threshold for pure tones at 500, 1000, and 2000 hz (ANSI, 1969). The IQ measure is the WISC-R Performance test.

Table 2

Coding Categories of Communicative Function

Category	Definitions and Examples
	<u>Directive Categories</u>
Corrects	Expresses disagreement with or disapproval of partner's response of behavior; "No, it's not a dog." "Babies don't eat apples."
Requires	
Action	Direct and indirect commands, or suggestions for action; "It's time for the baby to eat."
Language	Explicit or implicit prompts for specific language form; "Say, ..." form;
Test Information	Requests for information which is known; "What is this?"
	<u>Nondirective Categories</u>
Permission	Requests permission to act; "Can I put the baby here?"
Clarification	Requests clarification of speaker's previous CA; "What?"
Real Information	Requests information which is not known; "What will baby eat?"

States/comments	Provides information or comment; "Mother is going for a walk."
Expands	Imitates partner in whole or in part, and/or expands upon partner's utterance.
Conversational Devices	Fillers, calls for attention and praise.
Pretends	Role plays the action of a doll figure.
Other	CAs whose function does not fit into the above categories.
Incomplete	CAs which, although intelligible, are too incomplete to classify.
Unintelligible	Vocalizations, signs, & gestures which are partly or totally unintelligible.

Table 3

Summary of Analyses of Variance on Characteristics of Interaction

Characteristic	First Round		Final Round		p values		
	A/O	TC	A/O	TC	Mode	Time	MxT
% totally unintelligble							
- Mothers	0.5	0.6	0.4	0.4	-	-	-
- Children	16.4	8.0	8.0	2.2	**	***	-
% partially unintelligible							
- Mothers	0.3	0.5	0.4	0.4	-	-	-
- Children	14.4	6.1	11.0	7.4	*	-	-
% incomplete							
- Mothers	0.8	0.6	1.9	1.5	-	*	-
- Children	0.2	1.6	1.4	1.8	-	-	-
Time (minutes)	3.6	9.0	10.1	10.1	-	*	-
Total CAs/minute							
- Mothers	13.1	9.7	10.5	7.1	**	***	-
- Children	6.2	5.5	6.9	4.8	+	-	-
- % Mothers	67.0	64.0	59.0	61.0	-	**	-
Codable CAs/minute							
- Mothers	12.9	9.6	10.3	7.1	**	***	-
- Children	5.1	5.0	6.2	4.5	-	-	-
- % Mothers	71.0	65.5	61.2	61.0	-	***	-

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4

Summary of Analyses of Variance on

Communicative Functions of Mothers

	Group Means				p Values		
	First Round		Final Round				
Category	A/O	TC	A/O	TC	Mode	Time	MxT
(Total Directive)	31.0	35.4	27.5	28.4	-	-	-
Corrects	1.8	1.7	3.5	3.4	-	-	-
Requires							
- Behavior	22.1%	27.1%	17.5%	20.5%	-	*	-
- Language	1.9	3.1	0.9	2.1	-	-	-
- Test Info	5.2	3.5	5.5	2.4	-	-	-
(Total Nondir)	69.0	64.6	72.5	71.6	-	-	-
Requests							
- Permission	0.1	0.0	0.3	0.2	-	-	-
- Clarification	1.4	3.1	1.2	3.7	**	-	-
- Real Info	9.9	6.2	16.7	14.7	-	***	-
States/comments	36.0	29.3	31.9	27.7	-	-	-
Expands	5.1	5.1	5.5	7.6	-	-	-
Convers Devices	16.4	20.6	16.9	17.5	-	-	-
Play	0.2	0.3	0.1	0.1	-	+	-

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 5

Summary of Analyses of Variance on

Communicative Functions of Children

	First Round		Final Round		p Values		
Category	A/O	TC	A/O	TC	Mode	Time	MxT
(Total Directive)	12.8	16.8	5.8	14.1	+	+	-
Corrects	5.8	3.6	3.2	5.8	-	-	+
Requires							
- Behavior	6.6%	10.4%	2.4%	5.5%	-	+	-
- Language	0.0	0.1	0.0	1.7	-	-	-
- Test Info	0.1	0.0	0.0	0.0	-	-	-
- Ambiguous	1.0	2.5	0.2	2.0	**	-	-
(Total Nondirective)	87.2	83.2	94.2	85.7	**	-	-
Requests							
- Permission	1.4	2.1	1.0	1.4	-	-	-
- Clarification	3.9	1.1	5.4	2.5	+	-	-
- Real Info	1.0	2.5	3.0	4.2	-	+	-
States/comments	43.6	37.3	56.6	53.2	-	***	-
Expands	10.9	8.9	5.6	3.5	-	*	-
Convers Devices	25.7	28.6	21.5	20.0	-	*	-
Play	0.3	2.1	1.1	0.5	-	-	-

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 6

Simple Correlations between Child Characteristics and Maternal Input (First Round)

Measure	Age	HTL	IQ	Expres Comm	Recep Comm	Sent Comp	SocDev
Control Indices							
Dominance	-.47**	.10	.30*	-.30*	-.28*	-.25+	-.36*
Directiveness	-.10	.40**	.08	-.20	-.11	-.10	.02
Communicative Functions							
Corrects	.20	.52***	.12	.15	.21	-.04	.16
Requires							
- Action	-.13	.35*	-.07	-.11	-.03	-.01	-.05
- Language	-.25+	.01	.20	-.34*	-.33*	-.18	-.10
- TestInfo	.18	-.14	.09	.02	.02	-.01	.20
Requests							
- Permission	-.31*	-.07	.21	-.25+	-.31*	-.13	-.29*
- Clarif	-.16	.14	.01	-.11	-.14	-.03	-.18
- RealInfo	.47**	-.32*	-.10	.54***	.44**	.46**	.43**
States	-.41**	-.16	.17	-.34*	-.44**	-.32*	-.49**
Expands	.45**	-.02	-.02	.40**	.29*	.31*	.35*
ConversDevices	.18	-.09	-.23+	.14	.29*	.07	.22
Pretends	.30*	.08	-.18	.45**	.36*	.28+	.29*

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Note: The child characteristics are as follows: age in months (Age), pure tone thresholds (HTL), WISC-R Performance IQ (IQ), expressive communication (ExpresComm), receptive communication (RecComm), sentence comprehension (SentComp), social development (SocDev).

Table 7

Simple Correlations between Child Characteristics and Maternal Input (Final Round)

Measure	Age	HTL	IQ	Expres Comm	Recep Comm	Sent Comp	SocDev
Control Indices							
Dominance	-.43**	.16	.23+	-.43**	-.41**	-.43**	-.23+
Directiveness	-.04	.25+	.04	-.12	-.10	-.35*	-.42**
Communicative Functions							
Corrects	.04	.07	-.22+	-.11	-.15	-.32*	-.45**
Requires							
- Action	-.09	.20	.12	-.03	.05	-.14	-.37*
- Language	-.14	.39**	.19	-.17	-.24+	-.15	-.09
- TestInfo	.11	-.00	.01	-.04	-.06	-.26+	.11
Requests							
- Permission	.03	-.07	.00	-.19	-.13	-.27+	-.08
- Clarif	.09	.12	-.19	.31*	.26+	.35*	.29*
- RealInfo	.15	-.04	-.20	.23+	.19	.22	.43**
States	-.23+	-.14	.30*	-.37*	-.23+	-.12	-.02
Expands	.18	-.12	-.33*	.29*	.22+	.33*	.36*
ConversDevices	.19	-.14	-.10	.39*	.19	.35*	.02
Pretends	-.32*	.05	.05	-.64***	-.30*	-.26+	-.02

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 8

Partial Correlations between Indices of Maternal Control and Measures of Development (Raw and Residual Scores)

Measure	ExpresComm	RecComm	SentComp	SocDev
Dominance				
- Raw score	-.36*	-.17	-.10	.41*
- Residual score	-.23	-.11	-.10	-.16
Directiveness				
- Raw score	-.18	-.03	.00	.07
- Residual score	-.16	-.16	.22	-.05

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 9

Partial Correlations between Communicative Function Categories and Measures of Development (Raw Scores)

Measure	ExpresComm	RecComm	SentComp	SocDev
	Directive Categories			
Corrects	.06	.02	-.07	-.52**
Requires				
- Action	-.05	-.16	-.04	.14
_ Language	-.08	.18	.18	.10
- Test Info	-.24	.10	-.03	.03
	Nondirective Categories			
Requests				
- Permission	.17	.14	-.17	-.47**
- Clarification	.21	-.16	.00	.03
- Real Info	.12	.09	.08	.07
States	-.16	.13	-.23	.04
Expands	.14	.33+	.00	-.02
ConversDevices	.21	-.26	.24	-.17
Pretends	-.23	.03	-.17	.02

+ $p < .10$.

Table 10

Partial Correlations between Communicative Function Categories and Measures of Development (Residual Scores)

Measure	ExpresComm	RecComm	SentComp	SocDev
	Directive Categories			
Corrects	-.06	-.06	.25	-.36+
Requires				
- Action	-.03	-.32+	.11	.06
- Language	.05	.23	.20	-.01
- Test Info	-.27	.09	-.02	-.09
Requests				
- Permission	.10	.17	-.12	-.24
- Clarification	.13	-.17	.11	.24
- Real Info	.03	.07	-.02	.22
States	-.07	.31+	-.32+	-.02
Expands	.08	.22	-.01	.13
ConversDevices	.15	-.28	.13	-.21
Pretends	-.31+	.17	-.08	.08

+ $p < .10$.

Table 11

Factor Matrix for Mothers' Communicative Functions

(First Round)

Function	Factor 1	Factor 2	Factor 3	Factor 4
Real questions	.83191	-.14749	.21508	.10126
Expansions	.79648	-.01799	-.00643	-.06150
Test questions	.48048	.33951	-.28860	.00404
Req. language	.00820	.77708	-.09983	.04174
Req. clarific	.29684	-.60489	-.16222	.25616
States	.25668	.59808	.34031	.23039
Pretends	.00019	-.07529	.82718	-.06467
Req. action	.09748	.22963	.72439	.23301
Corrects	-.09914	-.05996	.03111	.89853
Conv. dev.	.47090	.15007	.18451	.53183

Table 12

Simple Correlations between Communicative Factors and Measures of Development (First Round)

Factor	Age	HTL	IQ	Expres Comm	Recep Comm	Sent Comp	SocDev
CommunInter	.41**	-.36+	.05	.51***	.40**	.46**	.51***
Didactic	-.38**	.04	.16	-.39**	-.37*	-.26+	-.10
ManipPlay	.10	-.04	-.06	.34*	.27+	.22	.22
PseudoInter	.05	.30*	.23+	.11	.18	.00	.10

+ $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Note: The factors are: communicative interaction (CommunInter), didactic, manipulative play (ManipPlay), and psuedo-interaction (PseudoInter).